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# Alternative Fortification Vitamin A for Lactating Mother Using Siomay Sauce Enriched with Red Palm Oil

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**ABSTRACT** : Siomay is a popular street foods in urban and rural areas of Indonesia. Due to its characteristics, siomay sauce can be incorporated with Red Palm Oil (RPO) for vitamin A fortification. The objectives of the study were determining the effect of RPO addition on the characteristic of siomay sauce, and determining the preference of siomay sauce added with various amount of RPO. A four levels addition of RPO (0.0 g, 1.5 g, 3.0 g and 4.5 g) were added to siomay sauce. The physical characteristics (viscosity and emulsion stability), sensory evaluation (hedonic test and duo-trio test) of the sauce, and the retinol equivalent of fortified siomay sauce were evaluated. The result showed that viscosity of siomay sauce increased with increasing addition of RPO into the sauce. The hedonic test revealed that the overall preference of original siomay sauce added with 4.5 g of RPO was not significantly different from the control. In addition, siomay sauce enriched with 4.5 g RPO could increase 325.22 µg retinol equivalents (RE) or equal to 38.26 % of the RDA of vitamin A for lactating woman. The finding suggest that siomay sauce fortified with RPO could be used for combating Vitamin A deviciency.

**Key words:** Fortification, Siomay sauce, RPO, Vitamin A.

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## INTRODUCTION

Vitamin A deficiency as well as other micronutrients have not been resolved in developing countries, including Indonesia. Vitamin A deficiency is one of the causes of blindness and premature death (Burri, 2012). Prevalence of vitamin A deficiency generally are toddlers, children, pregnant women and nursing women, especially those from low income population. Lactating women are in direct need of high vitamin A for fetal growth, breast milk production (ASI) and their baby's nutritional needs. Vitamin A that can be utilized directly and cannot be produced in the body is coming from animal sources. However, carotenoids from various vegetable sources affects

activity. One of the causes vitamin A deficiency is due to a lack of vitamin A intake from daily food consumption. One of the causes of vitamin A deficiency is due to a lack of vitamin A intake from daily food consumption. Fortification using pro vitamin A from vegetable sources is an alternative to increase public access to foods that contain high vitamin A (Dwiyanti et al., 2014).

According World Health Organization (WHO) (2009), the Vitamin A Nutrition Adequacy Rate for breastfeeding mothers is 850 µg RE (Retinol Equivalents). Meanwhile, WHO determined that 1 µg of RE (Retinol Equivalents) was equivalent to 6 µg of β-carotene for mixed foods. One of the most

abundant sources of provitamin A in nature is  $\beta$ -carotene Bardhani et al, (2009). Carotenoids are mostly a source of vitamin A which is widely found in vegetable ingredients such as green vegetables, fruits that are yellow and red and palm oil. Crude palm oil (CPO) is the world's largest source of carotenoids, containing more provitamin A than carrots (Benade, 2003).

Red palm oil (RPO), is a product of palm oil that rich in carotenoids such as  $\alpha$ ,  $\beta$ ,  $\gamma$ -carotene and tocopherol and tootrienol. The carotenoids in RPO mainly are  $\beta$ -carotene (48,2%) and  $\alpha$ -carotene (38,9%) (Cassiday, 2017). The concentration of  $\beta$ -carotene in RPO varies around 554-786 ppm depend on the condition of CPO as a raw material for preparation of RPO (Budiyanto et al., 2012). RPO that retained most of  $\beta$ -carotene could be used to prevent Vitamin A deficiency in children, pregnant women, and lactating mother (Radhika et al., 2003; Rita, 2011).

The addition of RPO into food products is considered beneficial because the  $\beta$ -carotene can be used as a functional food of provitamin A. Bagelen cookies produced with a substitution of the whole vegetable oil and 30% of coconut milk in original ingredient with RPO could improved its vitamin A up to 152.5 RE and able to improved 25.4% recommended dietary allowance (RDA) of vitamin A for an adult age group/day (Marjan et al., 2016). In addition, Supplementation of RPO by drinking 8 ml of RPO a day for 24 weeks reportedly reduce the risk of anemia in pregnant women (Radhika et al., 2003). Lietz et al. (2001) reported that RPO can be used as a supplement to increase the concentration of  $\alpha$  and  $\beta$ -carotene in breast milk. Furthermore, Novita (2017) states that batagor seasoning with the addition of 3%

RPO meets 12.13% RDA of vitamin A per day for children aged 9-13 years.

Siomay is a popular food can be found in various part of Indonesia. Siomay can be made using raw meat of fresh mackerel fish or other ingredients with tapioca starch and egg white components wrapped in dumpling skin (Nessianti and Dewi, 2015). Siomay is generally served with peanut sauce made from ground peanuts which are mashed and diluted with water. The ingredients for peanut sauce include red onions, garlic, sugar, tamarind, kitchen salt, and vinegar. The siomay sauce is a food product that has the potential to add RPO or  $\beta$ -carotene. The addition of RPO with high provitamin A content in Siomay sauce has the potential to improve the quality of siomay and can overcome vitamin A deficiency in the community.

The addition of RPO as provitamin A in siomay sauce is an effort to provide a type of food rich in vitamin A based on local food. However, the addition of RPO to Siomay sauce may affect the characteristics of the siomay sauce and is not necessarily accepted by consumers. The aim of this study was to examine the effect of physical, organoleptic and vitamin A characteristics which would be achieved by adding RPO to siomay spices.

## RESEARCH METHODS

A complete randomized design was carried out with one treatment, namely the addition of RPO (RPO) of 0 g, 1.5 g, 3.0 g, and 4.5 g in triplicate. The tools that have been used in this study were, T60 UV-VIS Spectrophotometer (PD-3000 UV APPLES), hot plate stirrer (JLab Tech 00.LTG), analytic scales, drop pipettes, 50 ml measuring cups (Pyrex), glass 1000 ml (Pyrex), erlemeyer 1000 ml (Pyrex) cups, Centrifuges (Hettich EBA

8S), bottles, thermometers, stirrers, vacuum devices, split funnels (Pyrex), glass funnels, test tubes, test tube shelves, Munsell Color Chart Plant Tissue, marbles, stereopam, aluminum foil, ruler, cup, tissue, toothpick, spoon, label paper, and bowl. Materials that have been used in this study are standard  $\beta$ -carotene, crude palm oil (Crude Palm Oil), NaOH 0.1 N (Merck®), 85% H<sub>3</sub>PO<sub>4</sub> (Merck®), PP indicator, aquades, petroleum ether (Merck®), acetone (Merck®), and Siomay bean seasoning.

Siomay sauce was purchased from the Siomay Mandiri Outletr. The composition of the ingredients for the siomay sauce consists of 250 g of peanuts, 10 red chilies, 4 garlic cloves, 10 g of brown sugar, 1 tablespoon of soaked tamarind water, salt, 2 orange leaves, 400 ml of water and lime juice. Four treatments of Siomay sauces were prepared by adding 50 g of siomay sauce with 0 g of RPO, 1.5 g of RPO, 3 g of RPO and 4.5 g of RPO respectively. Each siomay sauce that has been added with RPO were homogenized using a hand blender for 1 minute, followed by heating the sauce at 50° C for 1 minute.

### Physical Characteristics of Siomay sauce with addition of RPO

The viscosity of each sample was measured based on Stokes principle. The dropping ball (marbles) was dropped into a 50 ml measuring cup. The and time taken by the ball to pass the sample was recorded using the stopwatch. The siomay spice sample which has been added with RPO is viscosity tested in a 50 ml measuring cup at a height of 18 cm with a marbles radius of 0.753 cm. Viscosity measurement is calculated by the formula (Sukardjo, 2004):

$$\eta = (2 r^2 g (\rho_b - \rho_f)) / 9v$$

where :

$\eta$  = coefficient of viscosity (Ns / m<sup>2</sup>)

$r$  = radius (m)

$v$  = Speed (m / s)

$\rho_b$  = Mass of ball type (kg / m<sup>3</sup>)

$\rho_r$  = Mass of fluid type (kg / m<sup>3</sup>)

### Emulsion stability

Emulsion stability was observed every hour for 8 hours at room temperature hours because the sample only had a maximum consumption time of 8 hours. The emulsion observed was a mixture of RPO on the siomay sauce into the test tube and visually viewed every hour for 8 hours whether there was separation and measured and calculated the percentage of separation between oil and siomay sauce. The calculation of the percent stability is as follows:

$$\text{Emulsion Stability (\%)} = \frac{(\text{Sample Height (cm)} - \text{Separate layer height (cm)})}{(\text{Sample height (cm)})} \times 100\%$$

.....Yasumatsu et al, (1972)

### Sensory Evaluation

#### Hedonic Test

Hedonic tests (preference tests) are measurement responses to see preferences and likes and dislikes of an object or product. The hedonic test was carried out to determine the level of panelists' preference for siomay sauce products with the addition of RPO and from the level of preference obtained products that were liked and accepted by the panelists. The hedonic test is done with 7 hedonic face scales, which are 7 = very like, 6 = like, 5 = rather like, 4 = neutral, 3 = rather dislike, 2 = dislike, 1 = very dislike (Stone & Sidel, 1985).

The panelists used were 20 panelists who were breastfeeding mothers who were around Muara Bangkahulu

Subdistrict with testing sites at UPDT Puskesmas Nursing Beringin Raya. Panelists were asked to sample the four samples provided and give their personal responses about their likes and dislikes of siomay sauce on the attributes of four aspects, namely color, aroma, flavor and overall.

### Duo-Trio Test

The trio-trio test is used to detect the same difference between the two samples. Testing the trio was tested to see the difference in flavor between the siomay sauce without the addition of RPO and siomay sauce with the addition of RPO. The number of samples per test has two samples and one reference. Two samples and one reference were presented together before the panelists. Panelists are asked to taste the samples provided and find out the differences or similarities between the two samples with reference (R) and provide responses to the assessment sheets provided (Meilgaard et al., 1999)

### Provitamin A content in consumer-preferred seasonings

#### *B-carotene content*

Analysis of  $\beta$ -carotene content was carried out using UV-Vis Spectrophotometer (AOAC, 1975) based on the activity of  $\beta$ -carotene uptake on  $\alpha$  at a wavelength of 450 nm. Samples at various concentrations are used to create a standard curve of the relationship between absorbance and the concentration of  $\beta$ -carotene in the equation of  $y = ax + b$ . The content of  $\beta$ -carotene in the RPO sample is determined based on the absorbance and standard solution curves. The amount of RPO needed to meet the needs of vitamin A for 1 person is the same as Retinol Equivalents (RE).

The following calculation formula for vitamin A needs:

The ammount of RPO needed to supply vitamiiin A to one person = Retinol equivalent (RE) Burri (2012)

$$1 \mu\text{g RAE} = \mu\text{g } \beta\text{-carotene} / 6 \times 0,7a \times 0,7b$$

a = fraction retained after cooking (0,7)

b = fraction retained after storge (0,7)

### Data Analysis

Viscosity was analyzed using ANOVA at 5% level. If there are significant differences, the analysis is continued with Duncan's Multiple Range Test (DMRT). While the stability of the emulsion and color are analyzed descriptively by displaying tables. The data was analyzed by Tuckey test with a level of 5%. While the Duo-Trio Test is analyzed with binomial distribution tables.

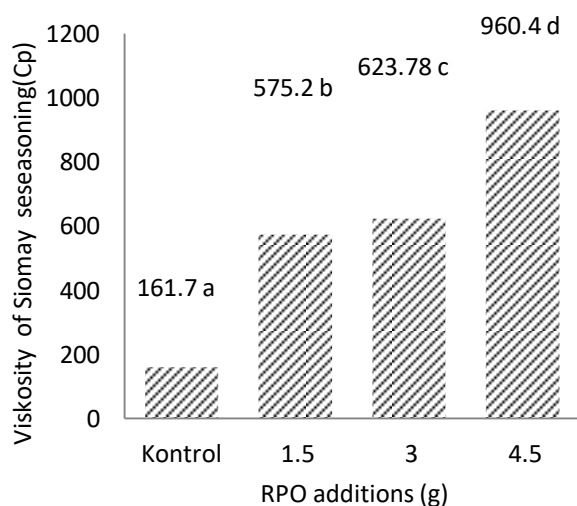
## RESULTS AND DISCUSSION

### Effect of RPO Addition on Physical Characteristics of Siomay sauce.

To determine the effect of the addition of RPO on Siomay sauce, testing of physical characteristics included viscosity, stability and color of the siomay sauce mixture with RPO.

#### *Viscosity*

The viscosity of the siomay sauce increases with the increasing concentration of the addition of RPO in the siomay sauce. The amount of viscosity of siomay sauce with various concentrations of RPO added to the siomay sauce can be seen in Figure 1.



**Figure 1.** Viscosity of Siomay sauce on various RPO additions

The results of one way Anova variance level of 5% showed that siomay sauce with the addition of RPO with concentrations of 1.5 g, 3 g and 4.5 g were significantly different to the viscosity of Siomay sauce. Based on further DMRT test showed that the viscosity of the addition of 4.5 g of RPO was significantly different from the viscosity with the kontrol, the addition of RPO concentrations of 1.5 g and 3 g.

In this case it can be seen that there is a relationship that the higher the concentration of addition of RPO (RPO), the higher the viscosity produced. This can be proven by the addition of RPO to increase the viscosity of the siomay sauce so that the siomay sauce becomes thicker and harder to flow or move (the time taken is longer) due to the siomay sauce with the addition of RPO with an oil-in-water emulsion, where oil red palm as a dispersed phase which is distributed in the form of small ganules in a continuous phase in the form of water, namely siomay sauce. The addition of RPO acts as an internal phase which greatly affects the viscosity of the siomay sauce, so that at different concentrations it will give a

difference on the viscosity of the siomay sauce

The viscosity of an emulsion is influenced by the concentration and type of emulsifier used. Viscosity is also affected by changes in composition. This is because the siomay sauce in its composition has supporting ingredients that make the siomay sauce have a high viscosity. Supporting ingredients in siomay sauce such as peanuts can increase the viscosity of siomay sauce. The oil contained in peanuts as a dispersed phase that can be emulsified well in spices. Peanut oil has unsaturated fatty acids but can increase the viscosity of vegetable oils (Usman et al., 2015). Kartika et al. (1990) stated that there is a linear relationship between viscosity and the concentration of a solution, increasing the viscosity of a solution with increasing concentration in a solution. Increased viscosity due to the addition of oil to the oil-in-water emulsion system was also reported by Ishartani et al. (2016) on oil additives in pasta tempeh kotro sword. The phenomenon of increasing viscosity that occurs in the addition of RPO to batagor seasonings is also reported by Novita (2017).

### Emulsion Stability

Emulsion stability refers to the ability of an emulsion to resist changes that occur over time, where the more stable an emulsion will be, the slower changes will occur (McClements, 2005). Stability in this study was carried out by observing visually determined the duration of stability (hours) and then calculated the percent stability (%). The stability of siomay sauce was observed for 8 hours to determine whether there was a separation due to the addition of RPO. This is due to the fact that the siomay sauce that is used is not material

resistance and only has a time span for optimum consumption is only 8 hours.

**Table 1.** Average time stability and percentage of seasoning seasoning stability

Addition of RPO (g)	Stability (Hours)	Percent Stability (%)
Control	8	100%
1,5 g	8	100%
3 g	8	100%
4,5 g	8	100%

Remarks: Control treatment and addition treatment of the concentration of RPO is stable for 8 hours or without separation of the siamay sauce emulsion

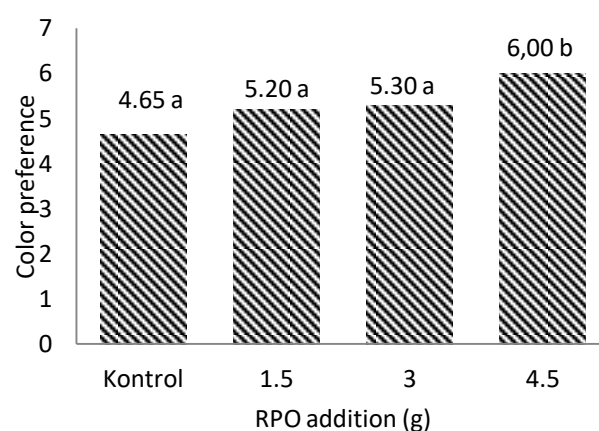
Based on Table 1, it can be seen that for eight hours the addition of RPO does not affect siamay sauce stability. Stability is affected by the viscosity of the liquid itself, the thicker the liquid the more stable the liquid is. The addition of RPO in siamay sauce makes the siamay sauce more stable and difficult to separate between water and oil. The stability of the emulsion shows the stability of an ingredient in the emulsion system or there is molecular uniformity of the dispersing phase and the dispersed phase in good condition. Separation of oil and water is an indicator of emulsion instability. The stability of the emulsion will increase in the use of higher oils (Evanuarini et al., 2016). This study is in line with the Novita (2017) study of the stability of batagor seasoning using RPO with a concentration of 0%, 3% and 6% having a stability of about 8 hours.

### Effect of RPO Addition to Bumbu Siamay's favorite

#### Color Acceptance

The influence of color on consumer Preference is one of the important complementary qualities so that

it can show signal quality products. The results of the hedonic color test on the addition of RPO to siamay sauce based on research can be seen in Figure 2 below:



**Figure 2.** Favorite color of siamay sauce on various RPO additions

Based on the results of one way Anova variance level of 5% showed that the addition of RPO had a significant effect on the level of panelists' preference for the attributes of siamay sauce. The results of further tests using Tukey test at the 5% level showed that the color of siamay sauce with the addition of 4.5 g of RPO was significantly different from the addition of RPO with a concentration of 1.5 g and 3 g and significantly different from the control (without the addition of RPO) The siamay season with the addition of 4.5 g of RPO has a higher value reaching a value of 6.00 (like) compared to the addition of RPO with a concentration of 1.5 g and 3 g and controls that have a level of preference (somewhat like)

Widhiastuti (2011) states that with the addition of RPO to Tutut sausage as much as 15% RPO (F15) can increase preference of better colors. This shows that the color that gets reddish yellow can increase the preference for siamay sauce. The addition of CPO or RPO in the process of making coconut sugar can improve the color of coconut sugar to be

brighter and make the value of coconut sugar color preference increase (Dwiyanti et al., 2014)

### Aroma Preference

The results of the aroma hedonic test on siomay sauce with the addition of RPO can be seen that the level of preference for the aroma of siomay sauce with the addition of RPO is lower than the control, even though the entire sample with the addition of RPO is still in neutral and somewhat like. In addition, the level of aroma preference between the siomay sauce samples that received additional RPO was not real. This indicates that the addition of RPO to siomay sauce can be done up to 4.5 g. Aroma is a very subjective and difficult to measure odor, because everyone has different sensitivity and preferences. Although they can detect, but each individual has different preferences (Meilgaard et al., 2000). The siomay sauce with the various addition of RPO did not give a real effect on the preference of the aroma. Despite of naturally palm oil has a distinctive aroma caused by the compound  $\beta$ -ionon (Winarno, 2004). The results of the aroma test can be seen in Figure 3 below:

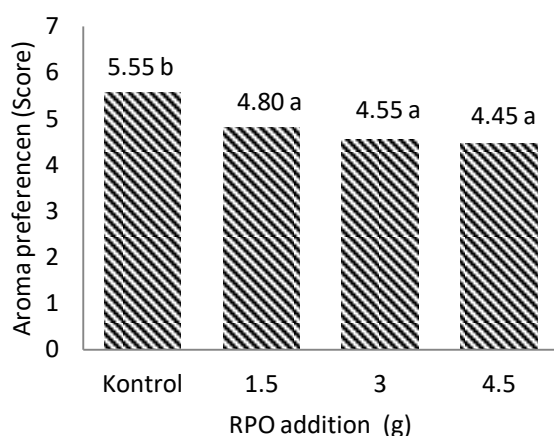


Figure 3. The Preference aroma of siomay sauce in various RPO additions

In this study, the addition of 3 g of RPO, panelists gave a higher assessment compared to the addition of RPO concentrations of 3 g and 4.5 g. However, the more red palm is added to the siomay season, the level of consumer preference for the product will decrease because the distinctive aroma of RPO which is less preferred is more dominantly covering the aroma of other ingredients so that the arising aroma is the distinctive smell of RPO so it is not preferred by consumers. According to Dwiyanti et al (2014) that the more addition of RPO, the level of preference for aroma in coconut sugar is actually decreasing. This is in line with the research of Widhiastuti et al. (2011) more and more RPO is added to the Tutut snail sausage product, the preference for the aroma of sausage is decreasing.

### Taste Preference

Taste is the most factor in making the final decision to accept or reject a food. Although the color, aroma and texture are good, if the taste is not good, the consumer will reject the product. The results of hedonic test studies on taste can be seen in the following figure 7:

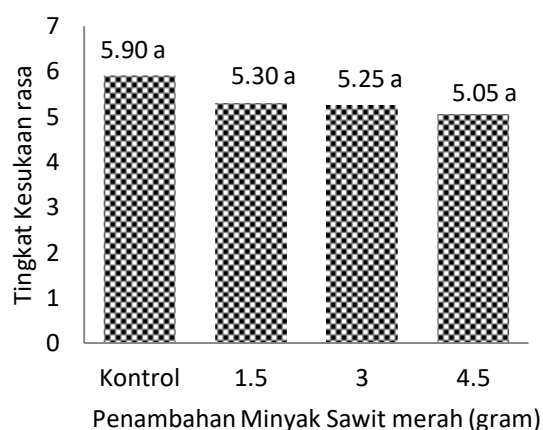


Figure 4. The Preference of siomay flavor in various RPO additions

An assessment of the level of preference for flavored siomay sauces was tested on breastfeeding mothers at the Beringin Raya Health Center UPTD showing that the flavor of the siomay spice was still the preferred range (the preferred scale of 5.05 to 5.30) by panelists both by adding 1 RPO , 5 g, 3 g and 4.5 g which are not significantly different from siomay sauce without the addition of RPO.

Each food ingredient will have a distinctive taste according to the nature of the material itself or the presence of other substances added during the processing so that the original taste becomes reduced or even better (Khairunnisa, 2015). According to Soekarto (1985) taste is a mixture of responses from taste, odor and trigeminal (vision, touch and sight), giving rise to psychological suggestions for food that determine the satisfying value of people who eat it.

The typical taste found in RPO is generally not preferred by consumers. The flavor of siomay sauce has a sweet and spicy flavor. The taste comes from ingredients added to the making of siomay sauce which can reduce the typical taste of RPO which is not favored by the panelists. The siomay sauce that are added with RPO are consumed with several types of siomay sauce made using different raw materials, such as chicken, fish, and tofu and vegetables so that they have different flavors. In addition, when served, siomay sauce are usually added sweet soy sauce, bottled chili sauce, and lime juice (Arkida, 2008). Thus, the combination of flavor between siomay and siomay sauce is thought to be able to neutralize the taste of RPO that is less preferred

### Overall Preference

Overall Preference is a parameter that is assessed by the panelists on the overall combination of the previous

parameters, namely the color, aroma and taste of the siomay sauce. Overall, the average level of preference for siomay sauce with the addition of RPO with a concentration of 1.5 g, 3 g and 4.5 g is at the preferred level by panelists ranging from 5.35 to 5.60. Although the results of color analysis showed differences in preferences, but based on the overall statistical test both in terms of aroma and taste there were no significant differences in both control (without the addition of RPO), concentrations of 1.5 g, 3 g and 4.5 g, so that the four concentrations of the addition of RPO to the siomay sauce which are used overall give no significant effects below:

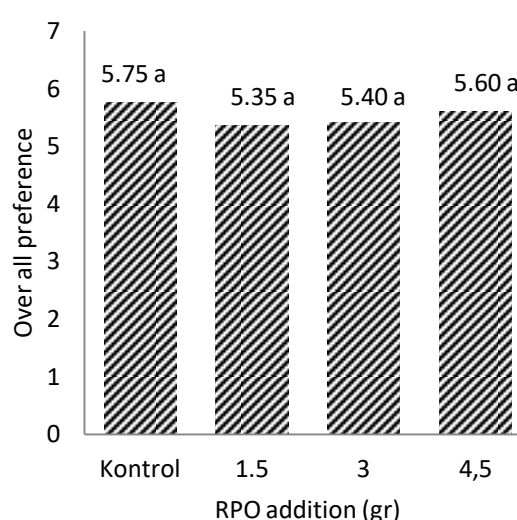


Figure 4. Overall preference of Siomay sauce on various RPO additions

The results of one way Anova variance level of 5% showed that the addition of RPO had no significant effect on the level of panelists' preference for the attributes of the siomay sauce overalls, but it was still well received by the panelists. The addition of 4.5 g of RPO has a higher overall value with a value of 5.60 (like) compared to the addition of RPO with a concentration of 1.5 g and 3 g with a value



of 5.35 (rather like) and 5.40 (Rather like) on a scale range of 1-7. Rodiyah (2017) stated that the highest average value in gilled meatball sauce products is 0%, 11% and 22% based on overall attributes, namely by adding 22% RPO with a value of 5.97 on a scale range of 1-7.

Based on the results of testing the overall level of preference showed that the siomay sauce with the addition of 4.5 g of RPO was chosen as the best treatment because it is preferred and can be accepted by the panelists and has the highest Preference, even though the attributes of aroma and taste are disturbing so that the assessment of preference not significantly different significantly. However, the addition of 4.5 g of RPO can improve the flavor of siomay and contribute to the higher content of provitamin A.

### Duo-Trio

This test is used to determine the differences between siomay sauce with the addition of 4.5 g of RPO with siomay sauce without the addition of RPO. In the duo duo test, all panelists consisting of 15 semi-trained panelists managed to distinguish correctly between siomay sauce samples without the addition of RPO with siomay sauce which received

4.5 g of RPO. Based on the binomial distribution table for duo duo testing with 15 panelists, it can be concluded that the two types of siomay sauce are different.

Based on the Duo-Trio test and hedonic testing on siomay sauce with various amounts of RPO addition, it can be concluded that the difference between siomay sauce without the addition of RPO with seasoning with an additional RPO of 4.5 g can be clearly felt, however, these differences (including various siomay sauce addition of RPO) is still in the range of scale preferred by panelists of breastfeeding mothers in accordance with the results of hedonic testing.

### Provitamin A content in selected siomay sauce

The  $\beta$ -carotene content contained in RPO (RPO) has been proven to have nutritional properties that are very beneficial for improving human health. Testing of  $\beta$ -carotene content is known to contain  $\beta$ -carotene in RPO by 433.33 ppm or equivalent to 72,27  $\mu\text{g RE} / \text{g}$ . Calculation of vitamin A (RE) RPO in 50 g of siomay sauce based on the RDA (Recommended Dietary Allowance) of vitamin A can be seen in Table 3.

Table 3. Provitamin A content conversion in 50 g of siomay sauce to the RDA (*Recommended Dietary Allowance*) vitamin A

RPO addition (g)	Vitamin A in a portion of siomay sauce	RDA vitamin A for lactating mother <sup>(1)</sup>	Vitamin A intake from one serving of siomay sauce
	( $\mu\text{g RE}$ )	( $\mu\text{g RE}$ )	(% RDA) (*)
1.5 g	108.41	850	12.75 %
3 g	216.81	850	25.51 %
4.5 g	325.22	850	38.26 %

Source : <sup>(1)</sup>WHO (2009); PERMENKES RI (2013)

(\*)based on RPO addition (g)

Based on the results of preference test that the siomay sauce with the addition of 4.5 g of RPO is the sample most favored by the panelists. Therefore addition of 4.5 g of RPO into one portion of siomay sauce with could improve vitamin A intake by 325.22 RE or increase 38.26% of RDA (Recommended Dietary Allowance) vitamin A.

The source of vitamin A in the diet comes from a variety of foods, both animal and vegetable sources. In the daily activities of breastfeeding mothers can also consume other sources of vitamin A contained in daily foods such as carrots, chicken meat, eggs, milk, green vegetables, tomatoes, etc. to be able to meet some of the needs of vitamin A. However, considering that one serving of siomay sauce (consist of 50 g of peanut sauce added with 4.5 g of RPO) served and consumed with various siomay products (fish meat ball, tofu, vegetable and boiled egg), the total Vitamin A intake of one serving siomay could meet RDA of vitamin A for lactating women. Consuming 50 g of siomay sauce RPO can help meet 38.26% RDA vitamin A.

In addition, the siomay sauce with additional 4.5 g RPO can be labelled as a source of provitamin A according BPOM rules (BPOM, 2011). Retaining high  $\beta$ -carotene in RPO could resulted a high provitamin A content.  $\beta$ -carotene content found in RPO varies depend on the stage process CPO. Budiyanto et al. (2012), stated that RPO from storage tanks contained an average of  $\beta$ -carotene 646.205 ppm. The results of the  $\beta$ -carotene content obtained in this study are smaller with  $\beta$ -carotene content in the literature. During processing,  $\beta$ -carotene loss due to heating in refining and storage of the oil (Benade, 2013; Budiyanto et al., 2010).

## CONCLUSIONS

From the results of research conducted on the effect of adding RPO as provitamin A on siomay flavor to physical characteristics,  $\beta$ -carotene content and organoleptic test, it can be concluded:

1. The addition of RPO significantly increase the viscosity of the siomay sauce. The color of siomay sauce changed from a slightly brighter yellow red to a bright red yellow after RPO was added to the seasoning. In addition all siomay seasoning remained stable for 8 hours. .
2. The consumer preference significantly different in color attributes, while taste and over all preference attributes were not significantly of different for all samples. Aroma, flavor and overall are not significant. The best siomay sauce for fortification purposes is the treatment of adding 4.5 g of RPO. The duo-trio test results showed the siomay sauce with the addition of 4.5 g of RPO to the flavor attribute was different from the reference sample and the sample without the addition of RPO. However, the difference is still in the range of scale favored by breastfeeding mothers panelists.
3. The addition of RPO which is preferred by consumers (4.5 g) could improve the provitamin A content of siomay sauce by 355.22  $\mu$ g RE (Retinol Equivalents) or 38.26% of RDA of vitamin for lactating women.

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